

ESSAY

BY

DR. CHARLES T. JACKSON,

OF BOSTON, MASSACHUSETTS.

LEAD PIPES

USED AS CONDUITS FOR DRINKING WATER,

CONTRASTED WITH

PURE BLOCK TIN PIPES.

BRIEF HISTORY OF LEAD DISEASES.

NEW-YORK, APRIL, 1852.

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ACTION OF WATER ON LEAD PIPES. POISONING BY LEAD.

Superiority of pure Block Tin Pipes for Aqueducts.

IT has been known for centuries, that water corrodes metallic lead, and forms a poison, which produces dangerous and even fatal diseases, when taken into the stomach.

Oxide and Carbonate of Lead are what are called by physicians *cumulative poisons*; that is, poisons which taken in minute doses, for a length of time, ultimately produce their peculiar effect on the animal economy, by their accumulation in the system, or by combination with the blood and organic tissues.

It seems very strange that any one should have ventured to deny these well-known facts in chemical and medical sciences; but it does appear that the question has been raised in this community, and doubts do exist in the public mind with respect to the danger of using leaden water pipes for conducting water for drink, into and through our dwellings.

It is true that lake water has less action on lead than either rain or well water; but it is an error to suppose that no action results from the contact of Cochituate Lake, or Croton River water with leaden pipes, or that an impervious coating of slime from these waters will prevent the further corrosion of the lead.

By actual trial I find, that there is no cessation in this corrosion, and that the water, from the day when it first began to flow through lead to the present time, contains sensible portions of lead, dissolved and suspended in it. If any one doubts this fact, he can easily satisfy himself by evaporating a gallon of the water from his lead aqueduct pipe to the bulk of half an ounce, by measure. Having rendered it slightly sour by means of pure acetic acid, then running through it a current of sulphydric acid gas, to full saturation, and warming subsequently the solution, he will obtain a black precipitate of sulphuret of lead, and by means of the blow-pipe, he can reduce this sulphuret to metallic lead. When the water has stood over night in the lead aqueduct pipe, the portion of lead dissolved in the water is considerable, and every discreet house-keeper, who is obliged to use lead aqueduct pipe, will do well always to draw off the contents of

the pipe in the morning before saving any water to use in cooking or for drinking. In this way the evil may be diminished, and much danger avoided.

It is better, however, to make use of water pipes which do not form poisonous compounds by corrosion and solution of the metal; and none have been found so available as those made of **PURE BLOCK TIN**. I have had abundant opportunities of testing the action of waters upon these pipes, and have never found any oxide or other form of the metal in water contained in them. I have tried Cochituate Lake water, Boston well water, and sea water, and have kept those waters for three weeks in coils of block tin pipe, from Le Roy's Works, and on analysis of the waters, after they were drawn from the pipes, no traces of tin could be found in them. The pipe being then slit open and examined, was not found to be in the least degree tarnished or corroded. I am therefore fully convinced that pure block tin pipes may be safely used for the conducting of water into and through our dwellings, and that no injury can arise from any action of water upon that metal.

It is essential, however, that the tin should be quite free from all alloy of lead, and that as little lead as possible should be used in soldering the pipe, for an alloy of lead and tin is acted upon by water, and lead with traces of tin is then dissolved by the water.

There is no reason to believe that tin pipe will be corroded by the action of lake water, and hence if the exterior of the pipe is properly protected from the action of nitrate of lime, sulphuretted hydrogen and other corrosive agents, which exist in the foil, that it will last for a great length of time. This protection is best made by laying the pipe in a wooden trough, and casting melted pitch, made of tar and rosin, around it; or the pipe may be bandaged with strips of stout canvas, laid on with hot pitch, and heavily coated with layers of hard boiled pitch. It is essentially desirable to protect the pipe from the *lime salts* and *nitre* which form close to the cellar walls of houses; the method above described will most fully serve this purpose.

It should be an object with plumbers to learn the best method of executing this work, rather than to find fault, and to throw all sorts of obstacles in the way of improvement, as many are disposed to do, the moment any innovation on old usage is attempted to be made.

Besides the advantage of preventing the exterior of the pipe from corrosion, the pitch will serve also to prevent the freezing of the water in the pipe—for resinous matters are very poor conductors of heat. This coating will also prevent any galvanic action from saline or metallic matters in the soil, and thus aid in preventing the corrosion of the pipe.

I do not know that tin is more likely to corrode in the soil than lead;

but lead pipes being made of weaker metal, have necessarily to be made thicker than those of block tin; and hence there is more metal to be acted upon, before the pipe can be perforated. Still we know that lead pipes, especially those made of crude lead, do corrode and have numerous holes perforated through them, both from the exterior and interior; and hence they often require to be taken up and renewed. Whereas if tin pipe is properly protected on the outside, there is no reason to believe that it would undergo any corrosion, or require to be removed. Thus, much trouble and expense may be saved in our cities, by having tin pipes properly protected, when they are put into the soil, so as not to require the frequent breaking up of the streets for repairing the pipes. I have long since been convinced that it is unsafe to use lead for any culinary purposes, or for conducting water by aqueducts; and have always, in medical practice, avoided the administration of any salts, or combinations of lead, internally.

That we have reason to fear the poisonous effects of lead, when so used, will appear from the following list of instances, in which I have found this poison in water, and in food. And in the brief history of a few cases which were under my observation, some years since, in which the use of sugar, poisoned with lead, was the cause of much sufferings, and of the death of several individuals.

Those who may wish to examine into the different forms of disease produced by lead poison, are referred to a work on Lead Diseases, translated from the original French of M. L. TANQUEREL DES PLAUCHES, by Dr. S. L. DANA, with notes and additions. (Lowell, 1848.)

In the present memoir I have chosen to confine myself to *my own observations* and researches. I am aware that the late Dr. MARTIN GAY, and Dr. A. A. HAYES, have made many researches on the action of water upon lead pipes, and that their results are confirmatory of the views entertained by me; and that in addition to my observations, they have proved that water from the Jamaica Pond Aqueduct, when drawn through lead pipes, is also charged with small portions of lead.

Many observations have also been made by Dr. DANA, of Lowell, and by Dr. CHILTON, of New-York, all resulting in the discovery of lead in water from lead pipes, and proving that the use of water so charged with lead, is injurious to the health of those who drink it.

I am aware, also, that cases of lead paralysis, from the use of water from lead suction pipes, have been treated at the Massachusetts General Hospital; and in one case, I made the analysis of a sample of the water that produced the disease, and found it *highly charged with lead*. This case was treated successfully by one of the House Physicians, by means

indicated by me as appropriate for the cure of lead diseases, notwithstanding the dispute that existed at the time, as to the fact of this case being one of poisoning by lead.

CASES OF LEAD POISON IN WATER.

The first case of lead corrosion that I was called to investigate, was brought to my notice in 1824. It was that of a leaden tank used as a reservoir for water collected from the roof of a house in Stamford-Street, in Boston. The water in this case was found by chemical analysis to be charged with oxide or carbonate of lead, and the tank was lined with crystalline layers of white carbonate of lead, and was deeply corroded in numerous places, so as to have become leaky. Several heavy coats of yellow ochre paint were found to serve as a protection from further action of the water upon the lead.

In 1834, two years after my return from Europe, I resumed my researches on lead poisoning; and the first case brought to my investigation was one that occurred in Bowdoin-Street, in Boston, where a leaden pipe was employed as a conduit for water from a well. In this water a dangerous proportion of lead was discovered, and means were taken forthwith to prevent the further use of leaden pipe in that well.

In 1835 I was called upon, as a physician and chemist, to examine into one of the most remarkable cases of accidental poisonings from lead, that has come to my knowledge. It was the famous case of the poisoned sugar sold at Calais, in the State of Maine. A gentleman well acquainted with the appearance of men suffering from the effects of lead in White Lead Works, near Boston, was the first to declare his belief to me of the sufferers that they had somehow got poisoned by taking lead into their system, and he also sent three of these patients to consult me. By careful enquiry I ascertained that only those persons who used sugar in their tea and coffee, at a certain boarding house in Calais, had suffered from this disease; and that there were several boarders in the house who did not use sugar, and that they were quite well. This at once fixed a suspicion upon the sugar, and I forthwith sent to Calais and procured samples of it. The grocer who sold the sugar did not believe it was poisonous, and therefore sent me the sample marked No. 1 from another lot, and Nos. 2, 3 and 4 were of the kind that the sufferers had used. This was done to test the skill of the chemist, I suppose. I found no lead in No. 1, but in Nos. 2, 3 and 4, I found thirty-eight grains of oxide of lead in each pound of the sugar; and established the fact that the disease in each of the persons poisoned was the effect of lead. One of the patients was a young lady, who suffered first from lead colic, and then paralysis, of which she died on board the packet on her way to Boston, whither she was coming for medical advice. Her brother was one of my patients, and was cured by the use of sulphuric acid, lemonade and sulphate of morphia, with occasional purges administered at proper times; but it was more than a year before he was entirely well. Another of the patients, a stout man, was also relieved by the same treatment; but the third gentleman went to an older

physician, and was not cured, but gradually became very much emaciated and died in the course of the year, of lead poison. I published at the time an account of these cases in the Boston Medical Magazine.

The lead in this sugar was believed to have originated from the use of lead-lined vats used to contain the acid syrup of sugar cane in Barbadoes. The sugar was smuggled from the adjoining British Province of New Brunswick, and I subsequently learned that upwards of one hundred individuals had suffered injurious effects upon their health by the use of sugar from the lot which had been brought to Calais.

The perfectly even diffusion of the lead, in all the samples of sugar, proved that it must have been introduced in the process of manufacture in the state of solution, and that it was not an accidental mechanical mixture. The small portion taken daily of this sugar in tea and coffee, probably not more than four or five teaspoonsful per day, shows how powerful is this poison, even when taken in small quantities at a time.

In 1836 I had occasion to analyze some water that was brought to me from New Bedford, and which had been drawn by a lead suction pipe from a well. From the small quantity, five thousand grains weight, of this water, I extracted a distinct globule of metallic lead. This lead was in the water in the condition of some soluble salt, or of oxide.

In 1838 I had occasion to analyze some well water from a leaden pipe, for an eminent physician of Boston, and found 0.6 grain of oxide of lead in a gallon of the water.

In 1843 this water was again analyzed by me, and I found 0.18 grain of oxide of lead in a gallon of the water, and discovered, by enquiry, that two of the physicians of that institution were suffering obviously from lead colic and partial paralysis. I directed the use of sulphuric and lemonade, and sulphate of morphia, with occasional doses of Epsom salts, and learned afterwards that the disorder had been removed. The lead pipe was taken up, by my advice, and one of cast iron substituted, and there has been no trouble from the water since.

The same year I discovered lead in another specimen of water from a lead suction pipe in Boston.

I analyzed a portion of the blackened lungs of a patient who died of lead colic and paralysis, at the Massachusetts General Hospital, and found in eight hundred grains of the dried lung, globules of lead, by the usual process of reduction. I suppose the man had been a house painter, but I do not know the history of his case.

In 1844 I detected lead in water from a lead suction pipe in Brooklyn; and soon after in water drawn through a lead pipe in the town of Dedham.

In 1846 I discovered lead in water from a suction pipe of lead in Roxbury; and in water from a lead suction pipe in Lynde-Street. I obtained 0.72 grain of oxide of lead from the gallon.

In 1847 I found in water pumped through a leaden tube, in Beacon-Street, 0.56 grain of lead per gallon of the water.

The same year I detected 0.56 grain of oxide of lead in a gallon of water, from a lead pipe in Dedham.

A gentleman from Woburn, Mass., called upon me that year, and stated that his family, particularly the children, had suffered much from pain in their bowels, resembling, from his description, lead colic; and that the

water seemed to be the cause of the disorder, which was aggravated by drinking it. A man who lived in his family, and who called with him, had the strongly marked blue line, characteristic of lead disease, in his gums, and said he had suffered much trouble with his bowels, and was very dyspeptic, and had numbness of his arms and legs. The gentleman's wife had disease of the lungs, and was very feeble, but we do not know that she had true lead disease, as I did not see her. The water drank by this family ran through a leaden suction pipe of one-and-a-half inch bore, and extending fourteen feet down into the well, and twelve feet horizontally to the sink. His family had drank water, drawn through this tube for four years. On analyzing a gallon of this water, I obtained lead, which reduced to its metallic state, weighed 0.64 grain.

In 1848 my assistant chemist, RICHARD CROSSLEY, analyzed a sample of water from a lead pipe which yielded 0.037 grain of oxide of lead to the gallon of water; and in 1849 he analyzed water from a lead pipe in Woburn, which gave 0.06 grain of oxide of lead per gallon; and the same year he found in water from a lead pipe in Waltham 1.077 grains of oxide of lead in a gallon of the water. He also found 0.18 grain of oxide of lead in a gallon of water, from leaden pipe in a well in Roxbury; and also found lead in water from lead pipe in South Brookfield, Mass.

In 1850 Mr. CROSSLEY found 0.64 grain of oxide of lead in a gallon of water, in a lead pipe in Woburn.

In 1851 I had an opportunity of investigating a case of severe lead disease which occurred in Winchester, Mass., and of analyzing the water that had been drank in the family affected. The gentleman who called upon me is a piano forte maker, and employs a number of men in his business. He said that the water which supplies his house, is conducted from a spring, by means of a lead pipe five hundred and sixty feet in length, through which the water is constantly running. He brought one of his workmen to see me, who had very marked signs of lead disease. The gums were of a dark ashy-blue color, and there was a black deposit at the junction of the gums with the teeth. He has suffered much from lead colic and partial paralysis of his legs, and walks with great difficulty and awkwardness, as if his legs were "asleep." He says he has ceased to drink the water from the lead pipe, and has been slowly getting better. I analyzed this water, and was surprised to find water that had been allowed to run freely through this pipe, to be so highly charged with lead. I did not weigh the sulphuret of lead obtained, but know that it was in dangerous proportions in the water.

1852. I have examined a case of poisoned water for a lady in Westboro, Mass., who had suffered from lead pipe. In this water I found the extraordinary amount of two grains of oxide of lead per gallon of the water. I do not know the length or dimensions of the lead tube in this case, but I supposed it must be of considerable extent. The lady has ceased to drink the water from the lead tube, and is getting over the diseases she has been subject to, as above-described.

We have found traces of tin in water which was drawn through leaden pipes alloyed or soldered with that metal, in but two instances, and regard this as the result of the action of water on the alloy, never having found it in water from pure block tin pipes.

The above list of cases I draw from my laboratory notes, and omit the names of the parties, since it might not be agreeable to them to be drawn unnecessarily before the public. I have investigated a much larger number of instances of poisoning of water by lead, of which I took no notes in my laboratory books at the time, for want of the details of symptoms in the cases, or because I did not see the patients myself.

A sufficient number, I believe, is here given to prove absolutely the action of water upon lead, and that water charged with salts of lead does seriously affect the health of those who drink it for any considerable length of time.

CHARLES T. JACKSON,

Assayer to the State of Massachusetts, and to the City of Boston, &c. &c.

APRIL, 1852.

STATE ASSAYER'S OFFICE, 31 Summit-Street, }
Boston, April 12, 1851. }

MESSRS. DALTON & INGERSOLL—GENTLEMEN:—I have made careful chemical analysis of the Block Tin pipe you brought to my laboratory, and find that the $1\frac{1}{4}$ inch pipe is pure tin, with only a trace, not weighable, of foreign matter—100 grains of the pipe give 99,999 grains of absolutely pure metallic tin.

The $\frac{5}{8}$ inch pipe, made of a mixture of Banca and English Block Tin, yields in 100 grains, 99,362 grains of pure tin, and 628-1000 grains of copper.

The copper in the pipe was derived without doubt from the English tin. It operates favorably in rendering the tin tough, so that it draws better in smooth pipe. It does not in any way injure the pipe for the uses for which it is prepared, but on the contrary is advantageous to it, giving greater strength and more perfect smoothness. On testing this pipe with water no action took place, and the water which had remained in it 48 hours contained no traces of the metal. In regard to the use of this kind of pipe in houses for the conveyance of water, I would say that it is highly desirable that it should be universally substituted for lead pipe, which is, as is well known to all scientific chemists, corroded and dissolved in water, rendering it poisonous.

Lead is a cumulative poison, and the introduction of even minute portions of it into the system will ultimately produce disease in the human body. This is one of the best established facts of medical science. It is well known that Boston, and most if not all well water, acts rapidly on lead pipe, and the water becomes poisonous by passing through it. Even Cochituate water acts seriously on lead, and I know from my own researches that the water by passing through 60 feet of leaden pipe, was always found to contain lead, and that during two years I have proved that the corrosion continued, and that the water contained sensible portions of oxide or carbonate of lead. I am glad to learn that tin pipes can be furnished at nearly the same cost as lead, as the cost was the only valid objection ever brought against its general use, for the conduction of

Cochituate water into, and through our dwellings. The lightness of tin, and its great strength, are the facts on which this opinion rests; and I have no doubt that the enterprising manufacturers of these valuable pipes will receive that encouragement which they so justly merit. It is an improvement analogous to that made by the French Philosopher, M. LeCluire, whose humane exertions in substituting oxide of zinc in the place of white lead in painting, was thought worthy of being rewarded by the high distinction of the Cross of the Legion of Honor, the reward of merit given for brilliant achievements, and for great services rendered to humanity.

I have the honor to be respectfully your obedient servant,

CHARLES T. JACKSON, M. D.

Assayer to the State of Massachusetts.

We also subjoin some extracts from the May number of the SCALPEL, a New York Medical Journal, edited by Dr. Edward H. Dixon, in regard to the danger of using lead pipe:

"When the Croton was introduced into this city, a great time was made about the poisonous effect of lead, but it all subsided, as almost every other important question does with us, before the mass of the people obtained a glimpse of the truth. An immense number of instances are on record, and others are daily occurring, wherein persons have been poisoned by drinking water from leaden cisterns, pipes and newly painted roofs; the books and newspapers are full of them. According to an immutable law of nature, the lead is oxydized and carbonated by the oxygen and carbonic acid of the air, and then dissolved in the water by its frequent excess of carbonic acid. The rationale of this inevitable process, it is impossible to communicate to the ignorant; who, from that very ignorance, as well as their slovenly and filthy habits of cookery, are most exposed to danger.

Some very idle and absurd ideas have been held forth by interested persons, that the Croton water-pipes could not be acted on, because their contents were not exposed to the air. Where, then, in heaven's name, does this wonderful and anomalous water come from? Does not the water of springs and rivers contain air and carbonic acid, and can its action be prevented? They say that the lime the water contains, coats the pipes and prevents the action of the acid! And how, before this coating occurs? What is it that causes the constant corrosion and bursting of pipes all over the city? What has introduced an entire class of new diseases amongst us? Is there a physician of any observation or experience in this city who does not find frequent cases of slow intestinal pains, jaundice, indigestion, &c., to which in his earlier practice he was unaccustomed, and which he cannot trace to any hitherto acknowledged local cause, and which, moreover, do not admit of removal by his usual remedies? Depend upon it, reader, cases of lead poisoning are constantly occurring in this city; the Croton pipes have been found by chemical tests, repeatedly made, to give off lead to the water in quantities sufficient to produce the most direful evils. These pipes are constantly corroding, and bursting in consequence, all over the city. Lead should never have been used for service pipe.

* * * * *

Pure block tin pipe, which it has hitherto been supposed impossible to

make, is now manufactured of the most admirable quality, and yet very nearly as cheap as lead. We have examined this pipe, the result of the indefatigable industry and genius of our countrymen, T. O. LeRoy & Co., of Water street, and believe it to merit a place among the most useful improvements of the age. The firm of LeRoy & Co., are the only manufacturers of this article in this country. They assure us they will submit their pipe to be tested by any chemist, in any manner whatever, and will confidently rest its character for perfect purity, and fitness to insure the absolute safety of all who use the water thus conveyed to their dwellings. Sections of this pipe may be taken from any coil on their premises, and after being reduced to powder by the file, its purity throughout its entire thickness will then be equally apparent. Dr. Chilton, the eminent analytical chemist of this city, who proved the poisonous property of the Croton water after resting for a few days in lead pipe, has introduced the article of T. O. LeRoy & Co. into his chemical works, and pronounces it absolutely pure.

As the cupidity of landlords will not of course allow the vast majority of our citizens to enjoy the blessing, we caution all who wish to avoid poison, to take measures to ensure as much safety as they can, by drawing off a full pail of water every morning, before any is used for culinary purposes. Coffee particularly, as this is now made nine times out of ten with the water that has rested all night in the pipe, is often charged with a fair trace of lead."



COCHITUATE WATER AND LEAD.

EDITORS OF THE EVENING TRAVELLER:—I noticed in your Saturday Evening paper, under the caption "The Health of Boston," some remarks in relation to the influence of Cochituate water, and among them the following: "The iron and lead that was held in solution in the water, must have been exceedingly limited, for the most delicate re-agents did not detect them." It is not my purpose to criticise the remarks, which certainly excite surprise, coming as they do, from so respectable a source as the Boston Medical and Surgical Journal; but it is my DUTY, to express the fact, that the above statement is erroneous. The iron corroded from the pipes, is deposited as an ochre, palpable to the eye, at all times, and has never appeared in the water of the service pipes, as a solution. Not so the lead; the testings have been continued at intervals by experienced chemists, since the introduction of the water, and by myself during the past eighteen months almost weekly, AND IN NO CASE HAS LEAD CEASED TO BE DISCOVERED IN THE WATER. The interior surfaces of the lead pipes, show the effect of corrosion, which takes place with such water, in accordance with a natural law, as certain in its operation, as those we recognise in planetary motions. For years before this water was introduced, its corroding power was observed and registered, and the influence on the water, of the materials used in constructing the larger conduits, has been the subject of study since that time. For more than eighteen hundred years, the belief of the intelligent, that such water corrodes lead, has been

entertained, and it is a striking confirmation of its accuracy, that no record or observation of modern times, conflicts with this conclusion. It is only in its connection with chemical science, that I make this correction; the Hygienic influence of impregnated water, belongs to another department of science. Respectfully,

A. A. HAYES, Assayer to the State of Mass.

No. 1 Pine street, Boston, 9th Dec., 1850.

REPORT OF MASS. CHARITABLE MECHANIC ASSOCIATION.

The Committee of the Mass. Charitable Mechanic Association in their report of September, 1850, says, that "on the introduction of 'Cochituate' into the city, the most agitating and important question was, through what kind of pipes ought it to be conveyed for domestic use? It was evident that the material of which they are composed should be strong and durable, admit of ready repair and replacement, be sufficiently cheap to permit of general use, and above all, should impart no deleterious property to the water. Lead possessed all these requisites but the last, and on this account many of our citizens, apprehensive of the consequences, have introduced the water into their premises through pipes made of block tin, iron, tinned lead, glass, and gutta-percha. Of all these BLOCK TIN was preferable from its purity, strength, durability and other essential properties, with the single drawback that it was too expensive. It is with no ordinary pleasure, therefore, that we find that Messrs. LeRoy & Co. have completely obviated this difficulty. The specimens of Block Tin Pipe on exhibition, was of various sizes, from $\frac{1}{4}$ to $1\frac{1}{2}$ inches in diameter, and different thicknesses or strength; all having a surface like a mirror on the inside; and which can be sold by their agents at the same price per running foot, as that of lead pipe of the same strength. From the great advantages which we believe the public will derive, both in health and economy from this enterprise of the manufacturers, and as our appreciation of its value to the community, we would award to them a SILVER MEDAL."

The Mechanics' Association of Lowell, in their report for September, 1851, says of

"FOUR COILS PURE BLOCK TIN PIPE.—The Committee have examined the above specimens with great interest and care, and have been highly gratified in finding that the manufacture of an article hitherto deemed so difficult and expensive, has been brought at once to a very high state of perfection in this country; and that the community can now be furnished, at reasonable expense, with that great desideratum—a safe, convenient and durable medium for the conveyance of water."

LONDON ART JOURNAL.

T. O. LEROY & Co. of New-York, exhibit pipes of pure Block Tin, made in continuous lengths by hydraulic pressure, being the first successful attempt to produce this article by that method. The advantages of tin pipes over lead are many and decided ; they are stronger, lighter, less likely to get bruised or injured, will bend and work better, and are safe, sweet and incorruptible conduits for water or other liquors. Messrs. LeR. & Co. manufacture them at a cost nearly as low as that of lead pipes, thus obviating the chief objection to their employment.

The pipes made by Messrs. LeR. & Co. are from one-eighth of an inch to five inches in diameter, of uniform thickness, and free from all flaws, scales or splits. When we consider that lead pipes impart to the water which they transmit, a cumulative poison, ruinous to human health, we must regard the cheap production of pipes from pure tin as an important discovery.

The only objections to this new article of Tin Pipe arises from the prejudice, ignorance, or self-interest of parties who imagine that their *pockets* will be effected by the superiority of this new article. Some Plumbers object to it because but few of the trade are competent to make what is called a "wiped joint" upon tin pipe, though all know that the "socket," or "cup joint," made with a copper bit, is the least expensive and the strongest joint made. It is only necessary in working Tin Pipes to use fine solder, and exercise ordinary care. The most beautiful Plumbing work that can be shown in this whole city are those in which Tin Pipes were used, and the whole work looks as lustrous and perfect as burnished silver.



PURE BLOCK TIN PIPES

MANUFACTURED BY

T. O. LE ROY & CO.

Nos. 261 and 263 Water-Street,

NEW-YORK.

ALSO SOLD, AT MANUFACTURERS' PRICES, BY

DALTON & INGERSOLL,

No. 4 Union-Street, Boston, Massachusetts.

